FEBRUARY 11, 2005

UST SITE CLOSURE REQUEST

CROWN VALLEY CAR WASH
25991 CROWN VALLEY PARKWAY
LAGUNA NIGUEL, CALIFORNIA
OCHCA CASE #86UT179

SUBMITTED TO:

ORANGE COUNTY HEATH CARE AGENCY
ENVIRONMENTAL HEALTH
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PREPARED FOR:

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1.0 INTRODUCTION

Aqua Science Engineers, Inc., (ASE) has prepared a site closure request regarding past releases of gasoline at the Crown Valley Car Wash property located at 25991 Crown Valley Parkway, Laguna Niguel, California (Figures 1 and 2). This request has been prepared in accordance with California State Water Recourse Board Resolution at the request of the site property owner, Mr. Dipu Haque and the Orange County Health Care Agency (OCHCA). Active dual-phase soil and groundwater remediation was discontinued at the site as of May 1, 2004 under authority of the OCHCA.

This request for closure includes the following information:

- Brief site background and history.
- Hydrogeological evaluation of receptor risk.
- Surface waters contamination impact evaluation.
- Contamination degradation estimate for reaching MCLs.
- Cost benefit analysis.

2.0 SITE BACKGROUND

The Crown Valley Car Wash site currently operates as a car wash and Chevron fueling station. Four underground storage tanks (USTs) containing gasoline and diesel fuel exist at the site (Figure 2). The existing system is not suspected to be contributing to subsurface contamination. A release of apparent non-MTBE containing gasoline was discovered during 1986 from USTs that were located beneath the current car wash building. During April 1988, approximately 1,500 cubic yards of hydrocarbon contaminated soil were excavated from the former UST area and treated on-site. The treated soil was used to back-fill the excavation during January and February 1989. Active groundwater remediation using pump-and-treat technology was conducted at the site from June 1988 through November 1989. Approximately 70,000 gallons of hydrocarbon contaminated groundwater were treated during this time.

An additional release of gasoline containing MTBE is suspected to have occurred at the site from product lines some time prior to April 2000. Product line repairs conducted since that time are believed to have corrected this problem. Mobile dual-phase soil and groundwater remediation was conducted on a monthly basis at site in response to this fuel release from April 2003 through May 2004. Active remediation has been discontinued at this site under authority of the OCHCA. Provided in Appendix I is a summary of groundwater chemical analysis data for this site.

3.0 HYDROGEOLOGICAL EVALUATION

The subject site is located at a surface elevation of approximately 265 ft. AMSL adjacent to the eastern bank of Oso Creek at the Crown Valley Parkway bridge. Soils beneath the site, and in the Oso Creek stream bed, are recent alluvium derived from hillside erosion to the east and west of the site. Rock formation out-crops in this area include marine siltstone and terbidite facies of the upper Pliocene-age Capistrano Formation and Niguel Formation (Morton and Miller, 1981). The depth to the base of the recent alluvium beneath the site is estimated to be less than 100 ft.

Apparent native soil types encountered during drilling at the site consist of clayey silt (ML) from the surface to a depth of approximately 18 ft. below the ground surface (BGS), fine silty sand (SP/SM) from between approximately 18 ft. to 24 ft. BGS, and clay (CL) from 24 ft. to at least 40 ft. BGS. Hydrocarbon impacted groundwater beneath the site occurs in the silty sand layer located between 18 and 24 ft. BGS. This groundwater occurs in a perched condition above the clay soil. Mineral salts dissolved from marine sediments in the area have resulted in a high total dissolved solids (TDS) content in the groundwater (9,000 mg/l, Appendix II). Perched groundwater flow from the site is towards the south at an average gradient of 0.009 ft/ft (Figure 3).

Groundwater has been observed to seep into the concrete-lined channel of Oso Creek. It appears that the shallow perched groundwater in the silty sand layer is captured by Oso Creek down-stream of the site. Oso Creek also appears to act as a north-south trending shallow groundwater divide in this area. ASE collected surface water samples from Oso Creek at the locations of historic seep areas up-stream (sample Stream-1) and down-stream (sample Stream-2) of the subject site on December 29, 2004. These samples were collected approximately two days after a three day period of rain. Groundwater seepage from weep-holes or cracks in the concrete channel was not observed at the time of sampling. These samples were analyzed by Del Mar Analytical Laboratory for volatile fuel hydrocarbons (VFH) by EPA method 5030/8015M and for BTEX/fuel oxygenate compounds by EPA method 8260B. VHF and BTEX/fuel oxygenate compounds, including MTBE, were not detected in these samples (Appendix II). It appears likely that any hydrocarbon impacted groundwater that may be entering Oso Creek will be diluted to below detectable concentrations.

The water district that manages water resources in this area is the Moulton-Niguel Water District. According to Mr. Ray McDowell, Field Engineering Supervisor, the Moulton-Niguel Water District has no existing or future plans to utilize groundwater in this area for municipal supply (personal communication, February 3, 2005). The Moulton-Niguel Water District imports all of its municipal supply water and maintains no municipal supply wells. The nearest private irrigation well is located at the Schuller Ranch (citrus orchard) located approximately 2 miles south of the subject site.

It is the opinion of ASE that the hydrogeologial conditions, groundwater quality and water usage in the area preclude the groundwater contamination beneath the site, as it currently exists, from posing a significant risk to surface waters, groundwater resources or human health.

4.0 CONTAMINATION DEGRADATION RATE ESTIMATE

Insufficient data exists for this site to perform a sophisticated computer modeling of contaminant fate and transport that could be considered reasonably reliable. Furthermore, the cost of collecting the data necessary to prepare and execute this type of model does not appear to be justified by the apparent risk that may be caused by the existing contamination. However, sufficient information exists to graphically estimate contaminate flow rate, mass-flux and half-life. The graphically derived half-life can be used to estimate the time required for the groundwater contamination to reach maximum contaminant levels (MCLs) for drinking water. While the observed contaminant peak travel time between wells would reflect the influence of retardation factors, these factors are not derived. While BTEX continues to exist in groundwater beneath the site, the BTEX plume does not appear to be migrating off-site. The primary contaminant of concern is MTBE, which has migrated off-site. This compound is resistant to biological degradation and is much more mobile in groundwater environments than BTEX compounds.

Provided as Figures 4, 5, 6 and 7, are graphical representations of total petroleum hydrocarbon (TPH) and MTBE concentrations verses time for monitoring wells MW-1, R-7 and OM-5. Well MW-1 is suspected to be located near the area where MTBE-containing gasoline was released. Figure 7 indicates MTBE concentration reached a peak of approximately 1,200 μg/l in well MW-1 during July/August 2001. The slopes of the TPH and MTBE peaks for MW-1 are steep suggesting less influence from dispersion or other retardation factors as compared with R-7 located down-gradient from well MW-1. This condition further suggests that well MW-1 is located closer to the gasoline release area than R-7. Figure 7 indicates MTBE concentration reached a peak in well R-7 of approximately 1,100 during May/June 2003. The shape of the TPH and MTBE peaks for well R-7 are broader than MW-1 suggesting well R-7 is further from the source area and influenced to a greater extent by contaminant retardation factors.

4.1 MTBE Flow Velocity Estimate

MTBE flow velocity can be estimated by determining time period between peak concentrations that occur in well MW-1 (apparent release area well) and well R-7 (down-gradient well) as illustrated in Figure 7, and the distance between the wells. While MTBE behaves in a conservative manner as compared to BTEX, it is expected to flow at a somewhat slower rate than groundwater seepage velocity. Well R-7 is located near the center-line of the apparent groundwater flow direction from MW-1. Therefore, a correction for off center-line flow is unnecessary.

MTBE flow velocity (V_{solute}) is estimated as follows:

MTBE peak travel time between MW-1 and R-7: 1.75 years.
Distance between wells: 70 ft.

- V_{solute} = 70 ft./1.75 years = 40 ft/yr = 0.11 ft./day = 0.033 meters/day

4.2 Hydraulic Conductivity Estimate

Assuming V_{solute} approximates the seepage velocity (V_s) of groundwater flow, a hydraulic conductivity value (K) can also be estimated. However, as indicated previously, this K value is likely to be less than the actual K value determined by hydraulic parameters. For this estimate, it is assumed that $V_{solute} = V_s$

$V_{solute} = V_s = Ki/ne$
i = 0.009
ne = 0.20 (silty sand)

- 0.11 ft/day = K(0.009)/0.20
  K = 0.022 ft/day = 0.008 meters/day
  This value is in the published range for silt or sandy silt

4.3 MTBE Mass Flux Estimate

Groundwater flow (Q) and MTBE mass flux cross-sectional to flow direction at well OM-5 can be estimated using the derived K value (0.008), an estimated cross-sectional area of contaminant flow (a), and the average concentration of the MTBE in groundwater in well OM-5. The width, or Y-axis of the MTBE plume at OM-5 is conservatively estimated to be 160 ft. The height, or Z-axis of the plume is contained in the silty sand soil layer which averages 5 ft. in thickness. The concentration of MTBE in this well has remained relatively consistent over the past two years ranging between 220 and 398 μg/l.

Q = Kia
MTBE mass flux = (Q)(ave. MTBE conc.)
K = 0.008
i = 0.009
a = (160 ft.)(5 ft.) = 800 ft^2 or 74.3 m^2
ave. MTBE concentration = 300 μg/l

- Q = (0.008m/d)(0.009)(74.3 m^2) = 0.0053 m^3/day = 5.3 liters/day
  MTBE mass flux past OM-5 = (5.3 l/d)(300 μg/l) = 1,590 μg/day = 1.6 mg/day

4.4 MTBE Reduction Rate and Half-Life Estimate

A concentration reduction rate and half-life for MTBE can be estimated from the contaminant verses time graph for well R-7 illustrated on Figure 5. The MTBE graph for well R-7 is selected for this estimate because it has a more gradual negative slope, it is further from the apparent source area, and appears to be influenced to a greater degree by retardation factors than MW-1. These observations suggest well R-7 will provide relatively conservative values that are more representative of over-all site conditions as compared with well MW-1.

As illustrated on Figure 5, the concentration of MTBE in well R-7 decreases from a peak concentration of approximately 1,100 μg/l during June 2003 to approximately 150 μg/l during August 2004. This represents a reduction in MTBE concentration of 950 μg/l over a 14 month period. A concentration reduction rate is derived as follows:

- (950 μg/l)/(14 months) = 68 μg/l/month or approximately 2.3 μg/l/day

MTBE concentration in well R-7 reaches one-half of the peak concentration of 1,100 μg/l in a time period of approximately 250 days. In order to reach a MTBE concentration below the current MCL of 13 μg/l, a total of seven half-lives are required from June 2003 (250 days x 7 = 1,750 days or approximately 5 years). Therefore, assuming MTBE concentrations will continue to decrease at a relatively uniform rate, the estimated date MTBE concentration in well R-7 will be below the MCL is June 2008, or approximately 3.5 years from the current date.

4.5 Uncertainty Factors

The following limitations should be considered as factors that may introduce uncertainty into the values calculated in section 4.0:

- Contaminant concentrations depicted by the graphs between the quarterly groundwater sampling events are interpolated and may not be representative of actual concentrations during the time period gap. This condition may introduce error into the estimations of MTBE flow velocity, reduction rate and half-life.

- V_{solute} is used to approximate V_s. V_s is then used to calculate K and MTBE mass flux. While MTBE behaves in a conservative manner as compared to BTEX, it is subject to some degree of retardation and may flow at a slower rate than groundwater. Retardation factors for MTBE in soils having organic carbon fractions (f_{oc}) of 0.001 and 0.01 have been calculated as 1.1 and 1.6, respectively (Wiedemeier, et. al., 1999). Therefore, a V_s and a K determined by strict hydraulic parameters may be greater than the estimates derived in section 4.0 of this report.

- The estimated time for MTBE to reach the MCL at the location of well R-7 assumes MTBE will continue to decrease in concentration at a relatively uniform rate. Desorption of MTBE from soil or organic carbon that may occur as MTBE concentration in groundwater decrease, may result in a tailing effect that could possibly prolong the actual time to reach the MCL. Furthermore, if pockets of separate-phase gasoline product continue to exist at this site, the time to reach the MCL may aslo increase.

- The estimated MTBE mass flux is based on the assumption that the average concentration of MTBE detected in well OM-5 is representative of the plume concentration across the Y-axis intersecting OM-5. The MTBE average concentration across the Y-axis intersecting OM-5 may be different than observed in well OM-5.

4.6 Summary

Based on available assessment and groundwater monitoring data collected at the subject site, ASE estimates the following values for MTBE transport and fate:

- MTBE plume travel velocity (V_{solute}) = 0.033 meters/day
- Hydraulic conductivity (K) = 0.008 meters/day
- Mass flux of MTBE across Y-axis of plume at well OM-5 = 1.6 mg/day
- MTBE concentration reduction rate at well R-7 = 2.3 μg/liter/day
- Half-life of MTBE at the location of R-7 = 250 days
- Time to reach MTBE MCL at the location of R-7 = 5 years from June 2003 (June 2008).

5.0 COST BENEFIT ANALYSIS

The cost for conducting dual-phase extraction remediation at this site was charged at a rate of approximately $4,000 per month ($48,000 per year). The cost for conducting quarterly groundwater monitoring was charged at a rate of approximately $3,400 per quarter ($13,600 per year). The combined cost for corrective action (remediation and monitoring) at this site was approximately $61,600 per year. ASE estimates that continuance of active remediation at this site could possibly reduce by one-half the remaining time for on-site concentrations of MTBE to reach levels below the MCL. Therefore, assuming that the MCL could be reached by natural attenuation alone in approximately 3.5 years from the current date (June 2005), continued active remediation could possibly reduce this time by approximately 1.75 years. The cost to perform this extra period of corrective action would be approximately $108,000.

As stated in section 3.0 of this report, the hydrogeologial conditions, groundwater quality and water usage in the area preclude the groundwater contamination beneath the site, as it currently exists, from posing a significant risk to surface waters, groundwater resources or human health. Furthermore, degradation rate estimates indicate MTBE concentrations could reach levels below the MCL within 3.5 years by natural attenuation alone. Therefore, it is the opinion of ASE that the cost to continue active corrective action at this site is not justified by the additional benefit that may be received in the protection of water resources, human health or the environment in general.

6.0 CONCLUSION

It is the opinion of Aqua Science Engineers, Inc., that the Crown Valley Car Wash site should be considered for closure regarding past releases of gasoline from the UST system based on the following rational:

- The Moulton-Niguel Water District has no existing or future plans to utilize groundwater in this area for municipal supply. The Moulton-Niguel Water District imports all of its municipal water supply and maintains no municipal supply wells. The nearest private irrigation well is located at the Schuller Ranch (citrus orchard) located approximately 2 miles south of the subject site.

- Hydrocarbon impacted groundwater beneath the site occurs in a silty sand layer located between 18 and 24 ft. BGS. This groundwater occurs in a perched condition above dense clay soil. Mineral salts dissolved from marine sediments in the area have resulted in a high total dissolved solids (TDS) content in the shallow groundwater (9,000 mg/l).

- The hydrogeologial conditions, groundwater quality and water usage in the area preclude the groundwater contamination beneath the site, as it currently exists, from posing a significant risk to surface waters, groundwater resources or human health.

- Assuming MTBE concentrations will continue to decrease at a relatively uniform rate, the estimated date MTBE concentrations at well R-7 will be below the MCL is June 2008, or approximately 3.5 years from the current date. Continued active remediation could possibly reduce this time by approximately 1.75 years. It is the opinion of ASE that the cost to continue active corrective action at this site is not justified by the additional benefit that may be received in the protection of water resources, human health or the environment in general.

7.0 REPORT LIMITATIONS

Aqua Science Engineers, Inc., warrants that the services, findings and/or recommendations provided herein have been preformed and rendered in accordance with procedures, practices and standards generally accepted and customary in the consultant's profession for use in similar assignments. No other warranty, expressed or implied, is made.

The results of investigations described in this report represent conditions at the time and specific location at which soil and/or groundwater samples were collected and for the specific parameters analyzed for by the laboratory. The scope of this report does not fully characterize the site for potential contamination, or for contaminants not specified for analyses. Unidentified sources of contamination may exist that were not included in the scope of this investigation. All of the laboratory work cited in this report was prepared under the direction independent Cal-EPA Certifed Laboratories. The independent laboratories are solely responsible for the contents and conclusions of the chemical analyses reports.

Aqua Science Engineers, Inc.

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